

## Mobile PC 99

This chapter provides a summary of the key PC 99 requirements for mobile PCs, mini-notebooks, docking stations, and port replicators. Mobile PC systems have thermal, portability, battery run-time and battery life, size, weight, and connectivity tradeoffs required for their design that differ from the tradeoffs made for stationary systems.

**Important:** Unless a specific requirement or exception is defined in this chapter, the requirements defined in the “PC 99 Basic Requirements” chapter apply for mobile PCs. If there is a conflict with requirements or recommendations made elsewhere in this guide, the items in this chapter have precedence for mobile PCs.

The system requirements defined in this guide provide guidelines for designing PC systems that will result in the optimal user experience with typical Windows-based applications running under either the Microsoft Windows or Windows NT Workstation operating systems. These design requirements are *not* the basic system requirements for running the Windows operating system.

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## Introduction to Mobile PC Platform Guidelines

Many of the features required for PC 99 demand significant power and heat dissipation, which will not work physically in the notebook environment. For mobile PC users, the issues of greater importance are portability (weight) and availability (battery life). The mini-notebook, an emerging class of machines, presents new demands with more stringent constraints that also must be addressed.

New external buses, support for multimedia applications, and other changes in PCs challenge mobile PC designers to incorporate the features that users want in a way that does not reduce the value of the core system.

The overall goal for mobile PC design is the same as for PC 99 design—enhanced user experience—but the design tradeoffs are different. This section presents mobile PC requirements in a manner that will encourage industry innovation across a wide range of design solutions without creating extreme power demands. Mobile PC requirements allow OEMs the flexibility they need to manage power and heat considerations in their designs.

The OnNow and ACPI standards allow the operating system to take over the critical operations, such as dynamic configuration and power management, in support of mobile PCs.

The key mobile PC design issues include:

- Low weight and small size.
- Available battery life to meet user expectations.
- Power demands and heat dissipation on notebook computers managed to ensure reliable operation of internal components.
- Mobile units docked or connected to AC power versus battery power (DC).

Many of the projected uses for PC 99 computers include CPU-intensive and memory-intensive activities that further stress the power demands on mobile PCs.

## Mobile PC System Design Requirements

This section summarizes the additional design exceptions and design requirements for mobile PCs.

Unless an explicit exception is stated in this section, the PC 99 requirements apply for mobile PCs as defined in the “PC 99 Basic requirements” chapter. However, if there is any conflict with requirements or recommendations stated elsewhere in this guide, the items in this section have precedence for mobile PCs.

### 1. Mobile PC performance meets PC 99 minimum requirements

#### *Required*

For mobile PC systems based on Intel Architecture processors, minimum PC 99 performance requirements include the following:

- 266-MHz processor with Intel MMX technology and 128K L2 cache, or equivalent performance.  
This processor requirement does not specify a particular processor form factor or package type.
- 24-32 MB minimum system memory. The basic PC 99 limitations for memory available to the operating system apply for mobile PCs.  
Recommended: 32-64 MB RAM for Windows NT installations.

For mini-notebook requirements, see the “Mini-notebook Guidelines” section later in this chapter.

### 2. Mobile PC supports Smart Battery or ACPI Control Method battery

#### *Required*

Recommended: Smart Battery.

If Smart Battery is implemented, the battery must meet the requirements defined in the *Smart Battery System Specification*, and the charger must comply with the *Smart Battery Charger Specification, Version 1.0*, both of which are available at <http://www.sbs-forum.org>.

If a multiple-battery system using Smart Battery is implemented, the system must have a battery selector that complies with the *Smart Battery Selector Specification, Version 1.0*, also available at <http://www.sbs-forum.org>.

An ACPI embedded controller-based (EC-based) System Management Bus (SMBus) interface is required on systems that contain a Smart Battery solution, as described Section 13 of the ACPI 1.0 specification.

*Smart Battery Data Specification, Version 1.0*, is available from the web site at <http://www.sbs-forum.org>.

An ACPI Control Method Battery, defined in Section 11 of the ACPI 1.0 specification, also meets the PC 99 battery requirement.

**Note to reviewers: some fields will become required and returning constants for battery control will not be allowed. Details will be provided in a future draft.**

### 3. Expansion capabilities of mobile PC are accessible to users

#### *Required*

Expansion capabilities in a mobile PC usually require external connections and, occasionally, additional internal components. The expansion slot is almost always

physically blocked by access doors. Such doors are recommended for traveling integrity and to minimize entry of dust. This requirement is met if the user can access such external expansion slots without tools.

Internal expansion capabilities that require internal replacements, such as CPU, memory, built-in modem, and so on, are exempt from this requirement.

#### **4. Mobile PC connections use icons plus keyed or shrouded connectors**

##### *Required*

This requirement is the same as for PC 99 desktop systems, except that for mobile PC designs, with small-height considerations, connector icons might not fit on the back of the case. In such cases, it is acceptable to wrap the icons to the bottom of the unit or place them on the inside of an access door.

#### **5. Mobile PC includes one USB port**

##### *Required*

For mobile PCs, one USB port must be built into the PC, not provided solely by port replicators or docking stations, although these units can provide extra USB connectors. This USB port can be either a high-power or low-power port, or it can be dynamically configurable at the discretion of the OEM, as provided for by Section 7.2.1 of the USB 1.0 specification.

Mobile systems are **not** required to meet the requirement for the USB host controller to be able to wake the system from S3 state, as defined in requirement #2, "System design meets ACPI 1.0 specification and PC 99 requirements" in the "PC 99 Basic Requirements" chapter.

Mobile systems that have built-in keyboards are **not** required to include BIOS support for USB keyboards and hubs as defined in requirement #5, "BIOS meets PC 99 requirements for boot support," in the "PC 99 Basic Requirements" chapter.

#### **6. Mobile PC includes an IEEE 1394 port**

##### *RecommendedOptional*

It is recommended that a docking station should include at least one IEEE p1394a port, as defined in the "PC 99 Basic Requirements" chapter in Part 2 of this guide.

If implemented on a mobile PC, one IEEE p1394a-compatible walk-up port is required, and a second optional internal IEEE p1394a-compatible port is allowednot recommended. Also, the mobile PC should declare itself as a Power Class 04 device and must be able to source up to 3 watts for each attached PHY. These sources must stop providing power if they detect a higher voltage source on the bus segment.

All IEEE p1394a ports on a mobile PC must comply with the requirements defined in the latest IEEE p1394a specification. For more information about the related power management requirements, see the "IEEE 1394" chapter in Part 3 of this guide.

**7. USB-connected device does not maintain fully on power state***Required*

An internal device that connects to the mobile PC using USB must not continually maintain the system in a fully-on power state. Such a device will override system power-management settings that control power-saving modes to protect battery life. When any USB device is connected but not active, the driver must allow system power management to suspend the notebook.

**8. Mobile PC includes CardBus***Required*

At least one 32-bit Type-2 CardBus slot (not 16-bit) is required. Additionally, Zoomed Video (ZV) support is recommended.

**Note:** Each device in a multifunction add-on device—such as a CardBus card—must separately meet the power management device class specifications for its device class and be independently power managed. This means that both device A and device B on the same add-on card do not have to be idle before the devices can be power managed. For information, including all requirements for CardBus support, see the “PC Card” chapter in Part 3 of this guide.

**9. Mobile PC keyboard and pointing device meet PC 99 requirements***Required*

The internal keyboard and any built-in pointing devices such as a mouse, stylus, pen, touch pad, touch screen, trackball, stick, and so on required for a mobile PC should use standard system-board devices. The USB port can be used to support the requirement for external pointing device and keyboard connections. Alternatively, two PS/2-style ports can be implemented for the pointing device and keyboard, or a single PS/2-style port can be provided for both the pointing device and the keyboard.

For more information, see the “I/O Ports and Devices” chapter in Part 4 of this guide, which also provides information about implementing the recommended Windows and application logo keys on mobile PCs.

**10. Mobile PC includes IR devices compliant with IrDA specifications***Recommended*

If implemented, IrDA fast IR is recommended for synchronizing data exchanges with new peripherals such as digital still cameras. In addition, the software must have access to turning the interface off (D3 power state) and on (D0 power state) using bus-specific methods or the methods defined in Section 3.4 of the ACPI 1.0 specification.

For information about PC 99 requirements, see the “I/O Ports and Devices” chapter in Part 4 of this guide.

**11. Mobile PC includes support for installing the operating system***Required*

For mobile PCs, it is recognized that the system as purchased might not include all peripherals required for operating-system installation. It is recognized that the user might need to access another PC 99 computer using a serial, parallel, or network connection to complete installation.

**12. Mobile PC includes audio that meets PC 99 audio requirements***Recommended*

If audio is implemented in a mobile PC system, it must meet the requirements for PC 99 audio as defined in the “Audio Components” chapter in Part 4 of this guide.

For mobile PCs, the following exceptions and differences are defined for audio requirement #4, “Audio performance meets PC 99 requirements” in the “Audio Components” chapter:

- Dynamic range requirements are relaxed by 10 dB FS A.
- THD+N requirements are relaxed by 10 dB FS.
- Required frequency response is 20 Hz to 15 kHz, measured using 3 dB corners.
- Cross-talk requirements are relaxed by 10 dB FS.

Also, for mobile PCs that implement a 3.3V audio codec in order to decrease system power, the required Full Scale Output Voltage for line output is  $\geq 0.7$  Vrms.

These exceptions for mobile PC systems arise from the design challenges such as lower power and smaller form factors.

**13. Mobile PC includes communications device***Recommended*

Notice that the presence of a CardBus slot on the mobile PC meets the PC 99 requirement for providing either a modem or network adapter with a Mobile PC 99 system.

The exception for modems is that if modem capabilities are integrated in the base platform, then V.80 or better is required. If modem capabilities are not integrated in the base platform, then V.80 is recommended.

The exception for network adapters is that support is optional for remote new system setup capabilities as defined in the “Network Communications” chapter in Part 4 of this guide.

#### **14. Mobile system supports hot pluggable devices and alternative server connections**

##### *Recommended*

For a mobile system, the following are additional design considerations:

- Supporting hot-pluggable devices that do not require a system reboot for insertion or removal.
- Including alternative methods for server connection because a LAN or dialup connection might not always be available. Methods can include a floppy boot disk, PC Card network adapter, LAN on the system board, or docking to support remote new system setup.

Support for remote wake up is not required to be built into mobile PCs. A CardBus implementation that supports the power management event (PME) signal meets this requirement. For information about PME signal definition, see *PCI Bus Power Management Interface Specification for PCI to CardBus Bridge, Revision 1.0* or later.

#### **15. Mobile system meets Mobile Power Guidelines '99**

##### *Recommended*

The Mobile PC faces many power challenges in the future. The *Mobile Power Guidelines '99* are part of a comprehensive industry initiative that addresses these challenges to deliver mobile PCs that are high-performance, feature-rich, and power efficient. For more information, see the *Mobile Power Guidelines '99, Revision 1.0* or later, available from the web site at <http://developer.intel.com/design/mobile/intelpower/>.

#### **16. Mobile system includes CD-ROM drive**

##### *Recommended*

Because of form factor constraints, CD-ROM devices might not fit in a mobile PC.

If a CD-ROM drive is included in a mobile PC system, or is designed as an add-on device to be attached to a mobile PC system; the mobile CD-ROM drive must provide 4X or better performance, and the minimum mobile CD-ROM media transfer rate must be no less than 600 KB per second when running in the fully on (D0) state.

**Note to reviewers: please indicate the appropriate minimum required performance for the CD-ROM**

## Mobile PC Graphics Requirements

This section defines the specific requirements for graphics display capabilities on a mobile PC 99 system.

Unless an explicit exception is stated in this section, the PC 99 requirements apply for mobile PCs as defined in the “Graphics Adapter” chapter in Part 4 of this guide. However, if there is any conflict with requirements or recommendations stated elsewhere in this guide, the items in this section have precedence for mobile PCs.

### **17. Built-in display adapter meets PC 99 minimum capability**

#### *Required*

For a mobile PC’s external display support, the graphics subsystem must support the PC 99 requirements as defined in the “Graphics Adapters” chapter.

The internal graphics adapter must support 2-D hardware acceleration, and the primary display surface must be a minimum of  $800 \times 600$  resolution, with  $1024 \times 768$  recommended.

If an external secondary adapter is implemented, the display surface must be supported by at least all of the following minimum resolutions, including VESA standard timings.

- $640 \times 480$ : 8 bpp and either 15 bpp or 16 bpp
- $800 \times 600$ : 8 bpp and either 15 bpp or 16 bpp
- $1024 \times 768$ : 8 bpp

All resolutions must be non-interlaced and free from tearing.

**Note to reviewers: please comment on the appropriate refresh rates for external monitor support.**

### **18. Built-in display adapter with 3-D hardware acceleration capabilities meets mobile PC 99 minimum capability**

#### *Required*

Hardware-accelerated 3-D is not a requirement for mobile PC platforms, although some systems are implementing 3-D support in the 1999 time frame.

If a PC 99 mobile platform is designed to support hardware-accelerated 3-D, then the 3-D requirements for performance and features are required as defined in the “Graphics Adapter” chapter in Part 4 of this guide.

However, mobile 3-D chip sets currently being introduced are limited to 2 MB of local frame buffer memory. For 3-D resolution and performance requirements, only a few chip sets will be in compliance in the PC 99 time frame. To accommodate this and because of the design constraints in the mobile platform, the following exceptions apply for 3-D hardware acceleration for mobile designs.



- Required resolution for mobile PCs with 2 MB of local frame buffer memory is 640 x 480 (rather than 800 x 600 required for desktop systems) 16 bpp, double-buffered with Z-buffer.

No minimum texture cache is required.

**Important:** Mobile systems that include 4 MB of local frame buffer memory must support the 3-D requirements at 800 x 600 resolution.

**Note to reviewers: please comment on the proposed requirement for 800x600 when having 4M of frame buffer.**

- Hardware texture mapping is **not** required, as defined in requirement #31, “Hardware complies with texture size limitations” of the “Graphics Adapters” chapter.
- Specular highlighting and support for per-vertex fog are **not** required, as defined in requirement #27, “Hardware supports PC 99-required RGB rasterization” in the “Graphics Adapters” chapter.

### **19. Mobile system meets mobile PC 99 requirements for supporting multiple adapters and multiple monitors**

#### Required

Multiple adapter support is not required, unless the mobile system supports docking stations.

If a docking station is implemented, the base unit BIOS, graphics adapter, and driver must have support for multiple adapters as defined in the “Multiple-Adapter and Multiple-Monitor Support” section of the “Graphics Adapters” chapter in Part 4 of this guide. This support allows a user to add a graphics adapter in the docking station.

If a secondary external display connection is implemented on a mobile unit, multiple monitor support is optional for the internal adapter. The primary and secondary display do not need to support independent displays. Compromises are acceptable such that other graphics requirements do not need to be met while independent displays are attempted. For example, playing a 3-D game on the internal display while showing an MPEG movie on the external display does not need to perform to normal levels of acceptability or even work at all.

### **20. Built-in graphics adapter supports DDC monitor detection**

#### Recommended

Mobile systems are not required to support detection of the display based on the *Display Data Channel Standard, Version 3.0* (DDC), if the display is permanently attached and connected using an internal interface.

However, mobile systems must support DDC for the external interface port. The complete PC 99 requirements are defined in requirement #13, “Adapter supports DDC monitor detection,” in the “Graphics Adapters” chapter in Part 4 of this guide.

## **21. Mobile system with MPEG-2 or DVD playback features meets Mobile PC 99 requirements for video playback**

### **Required**

MPEG-2, DVD and DVD playback features are not required for a mobile system.

If video playback capabilities are implemented, the mobile system must support the related requirements as defined in the “Graphics Adapters” and “Video and Broadcast Components” chapters in Part 4 of this guide, with the following exceptions.:

For requirement #14, “Adapter supports video overlay surface with scaling,” in the “Graphics Adapters” chapter, the following specific items are **not** required:

- YUV 4:2:0 color format is not required.
- Scaling is not required (including underscan, overscan, and arithmetic stretching).

**Note to reviewers: Please comment on minimum standards for reduced size display.**

- IRQ support is recommended (rather than required), as defined in requirement #17, “Video port meets PC 99 specifications if present on graphics adapter,” in the “Graphics Adapters” chapter.

Mobile systems performance requirements are reduced, from those defined in the “MPEG-2 Video Playback Requirements” section of the “Video and Broadcast Components” chapter.

**Note to reviewers: The video playback performance requirements for mobile PCs will be defined in a future draft of these guidelines.**

## **22. Mobile system with AGP supports meets Mobile PC 99 requirements**

### **Required**

If AGP support is implemented in a mobile PC system, it must meet the PC 99 requirements defined in the “AGP Requirements” section of the “Graphics Adapters” chapter in Part 4 of this guide, with these exceptions:

- A minimum speed of 1x is acceptable for mobile PCs.
- GART support is recommended, rather than required.

If GART support is implemented on a mobile PC system, it must comply with the requirements specified in *AGP Interface Specification, Revision 2.0* or later.

### **23. System meets mobile PC 99 requirements if television output is implemented**

#### *Required*

Television output is not required for a mobile system. If this capability is implemented, the mobile system must support the requirements defined in the “Graphics Adapters” chapter in Part 4 of this guide, with the following exceptions:

- The television output adapter must use 2-tap minimum hardware filtering techniques for flicker reduction. All other requirements are as defined in item #38, “Adapter supports flicker filter,” in the “Graphics Adapters” chapter.
- It is acceptable for TV out to be enabled manually. Mobile PCs are not required to support automatic default boot mode as defined in requirement #36, “Default boot mode supports appropriate locate,” in the “Graphics Adapters” chapter.

If both NTSC and PAL are implemented, a safe means for using a mobile system with either system is required.

## Docking Station Requirements

Mobile PC docking systems allow docking of a PC, with additional hardware capabilities. A docking station allows the end user to add other devices to the mobile PC system—for example, sound, network adapter, hard disks, CD-ROM, different display adapter, SCSI, modems, and so on.

Docking systems can support hot, warm, or cold docking. Warm docking refers to docking and undocking the mobile PC while the system is in a low power state (as defined in the ACPI 1.0 specification) but is not powered off. Hot docking refers to docking and undocking the mobile PC while the system is operating at full power and is in an active working state.

Resource conflicts can occur when a mobile PC is paired with a docking station that allows users to add non-proprietary expansion cards to the system. For a mobile PC and docking station pair, the system designer must ensure that the docking system is capable of arbitrating resources for conflicts that might occur if an expansion card is added to the docking station. However, the system designer does not need to add to the mobile PC unit all of the PC 99 resource-arbitration capabilities.

The requirements in this section apply for mobile designs that include a docking station. There is no requirement that a mobile PC must have a docking station.

## Docking Definitions

This section defines the three types of docking modules that interface to a mobile PC platform.

**Port Replicator.** A port replicator is an external cable interconnect management module. A port replicator does not incorporate any active electronics. All cable connector receptacles on a port replicator are simple wiring extensions of the connector receptacles on the back panel of the mobile PC platform.

**Mini-Dock.** A mini-dock can perform the same functions as a port replicator with one additional feature: a mini-dock incorporates some form of active electronics to create extended mobile PC platform features and functions. The added active electronics might provide additional PC Card slots, communication receptacles, or both (RS-232, IEEE 1284, network interconnect, IEEE 1394, and so on).

A mini-dock can include a power source independent of the standard AC power adapter supplied with the mobile PC platform. The mini-dock should maintain its source of power when the mobile PC platform is removed from the mini-dock.

A mini-dock might not be user expandable to include desktop peripherals, I/O expansion cards, or both. To that extent, a mini-dock can be considered a “sealed” docking station.

**Docking Station.** A docking station, when interconnected with the mobile PC platform, is typically designed to extend the features and functions of the mobile PC to be equivalent to that of a desktop platform system. Requirements and specifications for features and functions available when a mobile PC platform has been interconnected with a docking station are, typically, the same as those for a desktop platform system.

A docking station incorporates native bus expansion slots. It is user expandable to include desktop peripherals and expansion cards.

## General Docking Requirements

The methods for the following dock identification scenarios can be supported by the system BIOS, which requires a mobile system to be aware of each type of docking station and features it supports, or by the docking station itself which could contain the ACPI table needed to differentiate the model, unique ID, and features in the dock. Either method would allow the system BIOS to pass this information to the operating system without actually having to support every conceivable combination.

Windows NT 5.0 requires that drivers for devices in a dock must fully support dynamic loading and unloading as well as all Windows NT 5.0-based power management and Plug and Play messages. In certain designs, some devices that

are normally considered system devices can be treated as static devices. In the case of a desktop system, static devices might not necessarily have to have their driver be capable of dynamically unloading—for example a custom keyboard driver, or custom storage driver. However, in some docking designs, such devices are sometimes “mirrored” in a docking station. Under these conditions, the driver must be able to be dynamically unloaded; otherwise, the operating system can not stop the device, thus preventing a mobile ejection.

#### **24. Docked mobile PC support state change notification using ACPI**

##### *Recommended*

When a mobile PC is “docked” to a port replicator, mini-dock, or docking station, specific notification must be made using ACPI methods to enable the operating system to properly change states or enumerate new devices that appear in the system. This notification must occur during a “hot” docking event or when the system returns from a warm or cold dock.

All notification events and docking control must be implemented as defined in Sections 5.6.3 and 6.3 of the ACPI 1.0 specification.

#### **25. Docked mobile PC have ability to identify the specific model of the dock**

##### *Recommended*

The system must be capable of uniquely identifying to the operating system a specific model configuration. This is to prevent the problems with current implementations that require the operating system to “cycle” different docking profiles at every docking event to try and identify what specific model of dock is attached.

#### **26. Docked mobile PC has the ability to uniquely identify the dock**

##### *Recommended*

The system must be capable of uniquely identifying an individual dock. This allow support for users that dock laptops into differently configured docks to have different features or settings at different locations and again prevents the operating system from unnecessary enumeration of the system on docking events.

#### **27. Mobile PC/docking station combination meets PC 99 requirements**

##### *Required*

There is no requirement that a mobile PC must have a docking station.

However, if a mobile PC supports a docking station, manufacturers must submit the combined docking station and mobile PC for PC 99 compatibility testing, and this combination must pass testing.

The docking unit must be able to power the mobile system and charge the mobile system’s battery under the control of the mobile system.

Some PC 99 requirements might apply to a mobile PC/docking station combination that do not apply to the mobile PC as a standalone unit. The intent for

PC 99 is that such requirements apply only because of facilities present in the docking station. For example, if a docking station provides graphics capabilities that substitute for the graphics capabilities of the mobile unit, the PC 99 graphics requirements apply for the mobile PC/docking station combination when the substituted graphics component is in use. If the mobile PC is supplying all graphics capabilities, then Mobile PC 99 graphics requirements still apply.

This does not require that all new PC 99 mobiles that have docking station support automatically have new docking station designs designed to meet PC 99 requirements. PC 99 mobile PCs can support docking stations that have already been tested to meet earlier design guideline requirements. The combination of a PC 99 mobile and an earlier design docking station must still be submitted for testing, and general system requirements still apply. The relevant requirements in this case are the following:

- The user cannot experience resource conflicts.
- All features must be functional.
- All drivers for earlier docking stations must be updated as necessary to support the pre-installed operating system.

For example, in order for older docking stations to work properly with a PC 99 mobile PC running Windows NT 5.0, all drivers must be updated to support dynamic loading, Plug and Play, and power management messages. This does not imply that new features must be added, but rather that the mobile system/operating system combination must have full control over the features in the docking station.

This exception does not imply that a new docking station can comply with a reduced set of PC 99 requirements based on an earlier design guideline. If a docking station is a new design released during the time that this design guide is in effect, such combinations of mobile and docking station must meet all PC 99 requirements.

## **28. Docking station meets all PC 99 system requirements**

### *Required*

The PC 99 requirements, as defined in the “PC 99 Basic Requirements” chapter in Part 2 of this guide, include requirements for OnNow and ACPI, Plug and Play, and bus and device specifications.

All PC 99 Plug and Play requirements must be met by the dock and its devices.

The docking station must meet the PC 99 BIOS requirement for multiple adapters and multiple monitors, which allows for the graphics capabilities in the mobile unit to be fully operational (either the LCD panel or external connector) in the event that an user adds another graphics adapter to the docking station.

Many docking stations support VCR-style docking in which the notebook is closed when docked, so the user is prevented from accessing the notebook display. It is recommended that users not be precluded from accessing their notebook display when docked and that users have the option of simultaneously using the main display on the docking station and the notebook display.

**Note:** ISA slots are not allowed in docking stations, as defined in requirement #30, “System does not include ISA expansion devices or slots,” in the “PC 99 Basic Requirements” chapter.

Windows NT 5.0 is designed such that all devices on a docking station (whether built in or added on) must be Plug and Play devices, either based on ACPI or a bus standard described in the PC 99 guidelines.

### **29. Docking station interface is supported using ACPI-defined mechanisms**

#### *Required*

The docking station interface must be implemented using mechanisms defined in the ACPI 1.0 specification. Non-Plug and Play devices are enumerated, configured, and disabled using ACPI. All notification events and docking control must be implemented as defined in Sections 5.6.3 and 6.3 of the ACPI 1.0 specification.

### **30. Mobile PC/docking station combination supports automatic resource assignment and dynamic disable capabilities**

#### *Required*

The mobile PC unit that is part of a docking system does not require all of the resource-arbitration capabilities required for expandable PC systems. However, the system as a whole must be capable of completely and dynamically disabling add-on devices and of freeing all the resources used by that device when the mobile unit is docked. This requirement excludes fixed-resource devices such as the DMA controller, interrupt controller, and so on.

With this capability, individual devices in the mobile PC will be disabled when it is docked, allowing the appropriate devices in the docking station to be enabled.

The system could fail if an add-on card requires resources that conflict with a device on either the mobile PC or the docking station. The mobile PC/docking station combination must be able to resolve resource conflicts among all the devices in the docking system.

This means that docking station devices must be available to replace disabled devices in the mobile PC, and these devices must meet the basic Plug and Play resource arbitration requirements for PC 99, as described in the “PC 99 General Device Requirements” section in the “PC 99 Basic Requirements” chapter. However, it is up to the design engineer of a mobile PC/docking station combination to determine which component (mobile PC or docking station) will resolve the conflict when the mobile unit is docked.

**Note:** Under Windows NT 5, drive letter assignments cannot change when drives are added or removed by way of a docking event. That is, all drives in the Mobile PC must retain their originally assigned drive letters.

For more information about resource arbitration when two devices such as two keyboards or two mice are present, see the “Automatic resource assignment and dynamic disable capabilities are supported” requirement in the “I/O Ports and Devices” chapter in Part 4 of this guide.

### **31. Docking station supports warm docking**

*Required*

Recommended: Support hot docking.

Docking or undocking a mobile unit from a docking station must not require powering off the system and must not require a system reboot.

Removable IDE devices are required to report changes by way of ACPI.

### **32. Docking system supports fail-safe docking**

*Required*

The system must provide a fail-safe system for docking and undocking the mobile unit. Working in conjunction with the operating system and ACPI (as defined in Sections 6.3 and 5.63 of the ACPI 1.0 specification), the mechanism for fail-safe docking must ensure the following:

- The undock button signals the user’s intent to the system.
- Docking can occur only when the mobile unit is in the correct power state. The power state depends on whether the system is designed to support cold, warm, or hot docking.
- The user can initiate undocking through Windows-based software choices. Notice, however, that a hardware “button” must also be provided, because experience shows that users often do not find the software option and remove mobile units without operating system notification.
- The undock button or software choice sends a signal to the operating system so that the user is warned if resources are in danger of being lost.
- A safe-undock indicator is provided so the user can identify when it is safe to remove the mobile unit. This can be an LED or any other mechanism chosen by the vendor. If a physical mechanism automatically undocks the mobile PC or if hot docking is supported, then the safe-undock indicator is not required.

There is no requirement for mechanical lockout to block the user from removing the mobile unit without operating-system notification.



## Mini-Dock Requirements

A mobile PC with a mini-dock does not need to meet the expansion card requirements and does not need to meet all the resource requirements of a mobile PC/docking station combination. A mini-dock is not required to provide an undock or eject button.

However, some mobile PC system designs include a mini-dock that has dedicated features for networking, additional PC Card slots, a CD-ROM, and so on. This means that the system could have additional resource requirements to the point that all available IRQs in the system are already allocated; in this case, the PC Card slots (for example) would not have any IRQs available, rendering them useless.

In such cases, the mini-dock must contain devices that replace any devices in the mobile PC that do not meet the IRQ, DMA, I/O port, and memory requirements for PC 99. This allows the operating system to disable the device on the mobile PC, to enable the corresponding device on the mini-dock, and then to arbitrate resources among the remaining devices in the mobile unit and on the mini-dock.

The requirements in this section apply for any mini-dock designed for a PC 99 mobile PC. There is no requirement that a mobile PC must have a mini-dock.

### **33. Mini-dock supports automatic resource assignment and dynamic disable capabilities for replacement devices**

#### *Required*

A mini-dock that can accept expansion cards must contain devices that replace any devices in the mobile PC that do not meet PC 99 requirements for IRQ, DMA, I/O port, and memory resources. This allows the operating system to disable the device on the mobile PC, to enable the corresponding device on the mini-dock, and then to arbitrate resources among the remaining devices in the mobile unit and on the mini-dock.

Devices in the system must be capable of being dynamically disabled so that the user can choose to free resources in order to allow other devices in the system to function.

**Tip:** To avoid resource shortages, the system designer can take advantage of the capability of Yenta-compliant CardBus controllers' capability to assign a shared PCI interrupt for R2 PC Cards, rather than using IRQs, as defined in the "PC Card 16 card driver supports sharing of level-mode interrupts" item in the "PC Card" chapter in Part 3 of this guide. For more information, see the related article at <http://www.microsoft.com/hwdev/busbios/>.

**34. Mini-dock supports warm docking***Required*

Docking or undocking a mobile unit from a mini-dock must not require powering off the system and must not require a system reboot.

Removable IDE devices are required to report changes by way of ACPI.

**Port Replicator Requirements**

A port replicator, as defined earlier in this section, needs to meet only the requirements defined in this section.

**35. System provides event notification using ACPI when mobile unit is attached to the port replicator***Required*

An event notification message must be sent and properly handled when the mobile unit is attached to the port replicator. All notification events and docking control must be implemented as defined in Sections 5.6.3 and 6.3 of the ACPI 1.0 specification.

**Mini-notebook Guidelines**

This section summarizes specific requirements for mini-notebook mobile PCs. All requirements in this chapter must be met by mini-notebooks unless an exception is specifically defined in this section.

For PC 99, a mini-notebook is defined as a system that has a carry weight of 3 pounds or less, including all hardware required to run the Windows operating system.

**36. Mini-notebook performance meets PC 99 minimum requirements***Required*

For mini-notebook systems, the minimum PC 99 performance requirements consist of the following:

- Intel Architecture 233 MHz processor with Intel MMX technology, or equivalent performance.
- 16 MB minimum system memory. The PC 99 basic requirements apply: no more than 4 MB of system memory can be locked and unavailable to the operating system.
- Minimum required display is 640 × 480 × 8 bpp. Compliance with 15-bpp or 16-bpp specifications is recommended.
- System includes all functionality required to run the Windows operating system.

All other Mobile PC 99 and PC 99 desktop requirements beyond those listed here as the minimum requirements are optional for mini-notebooks.

## Mobile PC 99 References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

*1394 Device Power Management*

<ftp://ftp.p1394pm.org/pub/1394pm/>

<http://www.microsoft.com/hwdev/onnow.htm>

*Advanced Configuration and Power Interface Specification, Revision 1.0*

<http://www.teleport.com/~acpi/>

*El Torito—Bootable CD-ROM Format Specification, Version 1.0*

*Compaq, Intel, Phoenix BIOS Boot Specification, Version 1.01*

<http://www.ptltd.com/techs/specs.html>

Intel hardware developer site

<http://developer.intel.com>

*Mobile Power Guidelines '99, Revision 1.0*

<http://developer.intel.com/design/mobile/intelpower/>

*PCI Bus Power Management Interface Specification for PCI to CardBus Bridge, Revision 1.0*

<http://www.pcisig.com>

Plug and Play specifications

<http://www.microsoft.com/hwdev/specs/>

Power management specifications for device and bus classes

Guidelines for audible noise and other OnNow technologies

<http://www.microsoft.com/hwdev/onnow.htm>

*Smart Battery Charger Specification, Version 1.0*

*Smart Battery Data Specification, Version 1.0*

*Smart Battery Selector Specification, Version 1.0*

<http://www.sbs-forum.org>

Windows and Windows NT DDKs

MSDN Professional membership

## Checklist for Mobile PC 99

If a recommended feature is implemented, it must meet the PC 99 requirements for that feature as defined in this document.

1. Mobile PC performance meets PC 99 minimum requirements  
*Required*
2. Mobile PC supports Smart Battery or ACPI Control Method battery  
*Required*
3. Expansion capabilities of mobile PC are accessible to users  
*Required*
4. Mobile PC connections use icons plus keyed or shrouded connectors  
*Required*
5. Mobile PC includes one USB port  
*Required*
6. Mobile PC includes an IEEE 1394 port  
*Optional*
7. USB-connected device does not maintain fully on power state  
*Required*
8. Mobile PC includes CardBus  
*Required*
9. Mobile PC keyboard and pointing device meet PC 99 requirements  
*Required*
10. Mobile PC includes IR devices compliant with IrDA specifications  
*Recommended*
11. Mobile PC includes support for installing the operating system  
*Required*
12. Mobile PC includes audio that meets PC 99 audio requirements  
*Recommended*
13. Mobile PC includes communications device  
*Recommended*
14. Mobile system supports hot pluggable devices and alternative server connections  
*Recommended*
15. Mobile system meets Mobile Power Guidelines '99  
*Recommended*
16. Mobile system includes CD-ROM drive  
*Recommended*
17. Built-in display adapter meets PC 99 minimum capability  
*Required*
18. Built-in display adapter with 3-D hardware acceleration capabilities meets mobile PC 99 minimum capability  
*Required*
19. Mobile system meets mobile PC 99 requirements for supporting multiple adapters and multiple monitors  
*Required*

20. Built-in graphics adapter supports DDC monitor detection  
*Recommended*
21. Mobile system with MPEG-2 or DVD playback features meets Mobile PC 99 requirements for video playback  
*Required*
22. Mobile system with AGP supports meets Mobile PC 99 requirements  
*Required*
23. System meets mobile PC 99 requirements if television output is implemented  
*Required*
24. Docked mobile PC support state change notification using ACPI  
*Recommended*
25. Docked mobile PC have ability to identify the specific model of the dock  
*Recommended*
26. Docked mobile PC has the ability to uniquely identify the dock  
*Recommended*
27. Mobile PC/docking station combination meets PC 99 requirements  
*Required*
28. Docking station meets all PC 99 system requirements  
*Required*
29. Docking station interface is supported using ACPI-defined mechanisms  
*Required*
30. Mobile PC/docking station combination supports automatic resource assignment and dynamic disable capabilities  
*Required*
31. Docking station supports warm docking  
*Required*
32. Docking system supports fail-safe docking  
*Required*
33. Mini-dock supports automatic resource assignment and dynamic disable capabilities for replacement devices  
*Required*
34. Mini-dock supports warm docking  
*Required*
35. System provides event notification using ACPI when mobile unit is attached to the port replicator  
*Required*
36. Mini-notebook performance meets PC 99 minimum requirements  
*Required*